### ABSTRACT

A Microwave Anechoic Chamber has been developed at the Department of Engineering, Nilai University, for monostatic and bistatic radar cross section measurements. The structure of the chamber is a quarter section geodesic dome with a 12-foot radius and raised 3 feet above the floor. An antenna railing system is installed inside the chamber. It consists of 6 rails, 30 degrees apart in azimuth angle around the dome. The antennas can be moved along the rails in the elevation direction, with the microwave beam pointing at the centre of the dome where the target is located. This design enables a very large combination of incident and scattering angles in bistatic measurements. Four transmit antennas are fixed at different elevation angles next to one of the antenna rails. Using an azimuth-over-elevation positioner as the pedestal for the target, and by positioning the movable antenna along that rail beside those fixed transmit antennas, monostatic measurements with incident angles ranging from 0° to 90° can be accomplished.

A vector network analyser is utilised to measure the amplitude and phase of the radar returns. GPIB interface bus is used to control various hardware components as well as to perform data acquisitions. A computer program has been written to automate the measurement system. Data are stored in raw format and processed later with a dedicated software so that different processing methods and parameters can be applied. The broadband measurement allows the conversion of frequency-domain data to a band-limited impulse response of the target of interest. Time-domain gating technique is used to remove the spurious signal in the time neighbourhood of the target.

A number of monostatic calibration techniques have been considered. The Isolated Antenna Calibration Technique [21] is used in the study to certify the measurement accuracy, polarisation isolation performance, time stability as well as the total system sensitivity. Some bistatic calibration techniques available in the open literature are also reviewed. The Conducting Sphere Calibration Technique [30] is selected to evaluate the bistatic performance of the measurement system.

An extended target with randomly distributed vertical dielectric cylinders over a metallic ground plane has been fabricated. Although the radar range does not satisfy the far field criterion, a technique to measure such target at short distance has been utilised and the measurement results are compared with calculations from a theoretical model by Karam et. al. [33].

The quietness of the anechoic chamber is also evaluated using the Free Space Voltage-Standing-Wave-Ratio field probe technique. An alternative method to derive the reflectivity level at the quiet zone is proposed. This method has the advantage that the reflectivity level can be calculated directly from the recorded standing wave curve in contrast to the conventional method, which requires the use of a tabulated graph. Nevertheless, it gives a result, which generally indicates a poorer performance, which means that a more stringent evaluation can be obtained.